Zinc Removal by the Microalga *Scenedesmus obliquus*

Cristina M. Monteiro, Paula M. L. Castro and F. Xavier Malcata

Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Rua Dr. António Bernardino de Almeida, P-4200-072 Porto, PORTUGAL
e-mail: cmmonteiro@mail.esb.ucp.pt

INTRODUCTION

Heavy metals are important pollutants of aquatic environments - and may even alter the structure of resident biological communities. Since they can not undergo any type of breakdown, accumulation in the sediments is an unavoidable consequence; they are then slowly released into the surrounding water, and will eventually become available to the higher levels of the food chain - hence posing a serious threat to human health.

Microalgae have attracted the attention of several investigators, aiming at heavy metal removal - because of their tolerance to high levels and high binding affinity; some species are able to grow in sites contaminated with those elements, and have developed the capacity to uptake them from the environment.

The major aim of this study was to test the ability of the green microalga *Scenedesmus obliquus* – previously isolated from a polluted location in Northern Portugal, to remove zinc from culture media.

MATERIALS AND METHODS

Culture conditions

- ✓ Microalga: *Scenedesmus obliquus*
- ✓ 1L batch cultures (pH=6.0)
- ✓ Initial cell density: 2.8×10^5 cells/mL
- ✓ Temperature: 18±1ºC
- ✓ 12:12h light:dark cycle
- ✓ Metal: Zn in the form of $ZnSO_4$
- ✓ [Zn]= 10, 25, 50 and 80 ppm

Experimental procedures

Three replicate flasks for each concentration

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75 mL - samples taken by 1, 2, 3, 4 and 7 d, and centrifuged at 4000 rpm for 15 min (at 4ºC)

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Zn content on supernatant, cell walls and intracellular analyzed by atomic absorption spectrophotometry

Fig. 1: Flasks containing experimental media and *Scenedesmus obliquus*, at various zinc concentrations

RESULTS AND DISCUSSION

The two lowest zinc concentrations induced growth of this microalga, hence zinc is a nutrient required in small but critical amounts for regular growth (Fig. 2).

Metal uptake at equilibrium was remarkably influenced by the initial metal ion concentration; at lower levels of metal the percent metal removed was higher (Fig. 3)

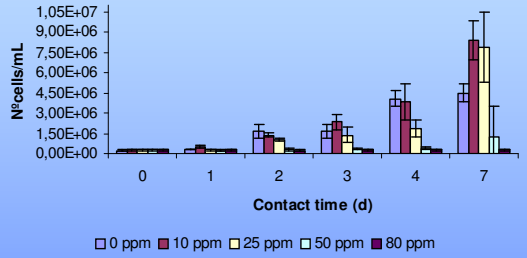

Fig 2: Growth curve of *Sc.obliquus*, at 10, 25, 50 and 80 ppm of Zn

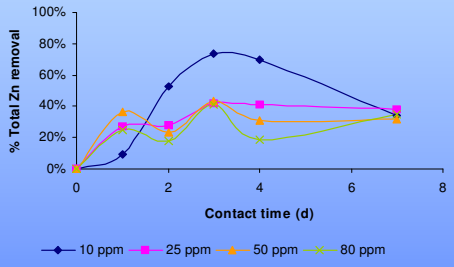

Fig 3: Percent removal of Zn, at distinct initial concentrations.

The highest percent removal was 73.3%, for 10 ppm Zn by 3 d of exposure.

Table 1: Zinc removed (mg/L) by 4 d in a culture of *Sc. obliquus* exposed to distinct initial zinc concentrations

Initial [Zn] added to culture (mg/L)	Total Zn removed	Zn Biosorbed on cell surface	Intracellular Zn
10	7.47	4.74	0.0049
25	10.35	7.04	0.0065
50	16.22	8.83	0.0119
80	14.68	7.94	0.0070

CONCLUSIONS

- ✓ *Sc. obliquus* can remove Zn from aqueous solution, up to 70% of under 10 ppm (ca. 40 mg/g algae)
- ✓ Microalgae can adopt a number of strategies to maintain low intracellular concentrations of heavy metals - which include metal binding to the cell surfaces

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